

# B10Plus+™

## Boron-10 (<sup>10</sup>B) Plus

Reuter-Stokes' B10Plus+™ line of <sup>10</sup>B neutron detectors combine the coating of our <sup>10</sup>B-lined detectors with a gas fill that includes Helium-3 (<sup>3</sup>He) to improve neutron sensitivity in a cost-effective manner in applications where enhanced sensitivity is needed.

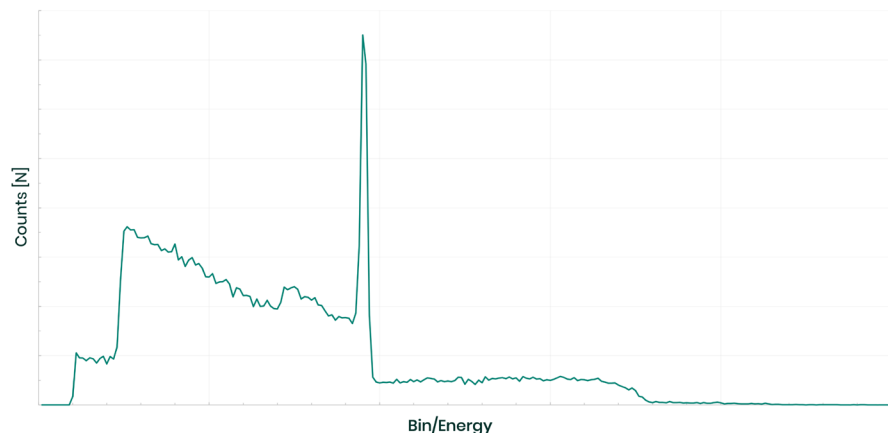
Operation of the B10Plus+™ detector is very similar to that of existing <sup>3</sup>He detectors. The neutrons react with the thin <sup>10</sup>B lining on the inside wall of the detector as well as the <sup>3</sup>He nuclei in the proportional gas. Combining these two neutron-absorbing materials into one detector results in higher neutron sensitivity.

B10Plus+™ is ideally suited for projects that have traditionally been driven to Boron trifluoride (BF<sub>3</sub>) proportional counters. In these instances, the B10Plus+™ detectors would have equivalent or higher neutron sensitivity without the shipping and handling hazards that can result with BF<sub>3</sub> detectors. Additionally, unlike BF<sub>3</sub>, it doesn't appreciably degrade over time.

## Pulse height spectrum

The combined energy spectrum for the B10Plus+™ detector displays the combined characteristics of both <sup>3</sup>He and <sup>10</sup>B detectors.

Example B10+ Spectrum (RS-B3-0839-213)



## B10Plus+™ offers:

Improved neutron sensitivity over Boron-10 proportional counters (varies based on amount of <sup>3</sup>He.)

Gamma discrimination that is comparable to existing <sup>3</sup>He detectors.

All the performance benefits of proportional counter technology.

Custom designs for various applications including international safeguards and homeland security.

A safe hazard free detector for easy use and transport.



# Low pressure detector plus $^{10}\text{B}$ coating equals Improved sensitivity with less $^3\text{He}$ needed

Cylindrical detectors' sensitivity to isotropic neutron flux scales linearly with active length, therefore:

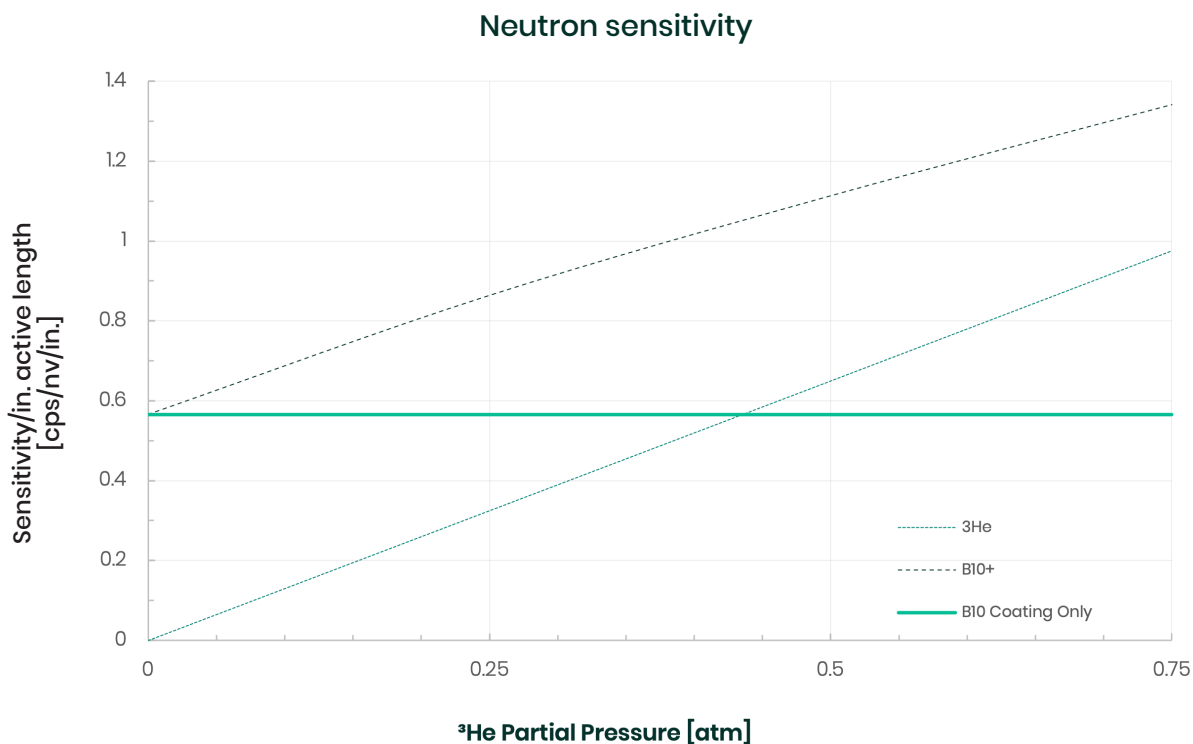
Sensitivity/active length (cps/nv/in.) is an effective means of comparing performance in some applications.

The sensitivity of  $^{10}\text{B}$ -lined detectors with optimized coating loading roughly scales with the coated surface area.

The best way to improve the sensitivity performance of  $^{10}\text{B}$ -lined detector when not space constrained is to increase the surface area.

The addition of up to 0.75 atm of  $^3\text{He}$  can be a cost effective way to boost the sensitivity of  $^{10}\text{B}$ -lined detector.

At higher pressures, sensitivity gains are reduced and not likely cost effective vs. using  $^3\text{He}$  gas as a detection medium alone.



## EXAMPLE

The  $^{10}\text{B}$  coating (optimized for single detector performance without  $^3\text{He}$ ) is placed on a 0.035" wall SS body shell 1" in diameter.

The  $^{10}\text{B}$ -lined detector has similar performance to a detector with ~0.4 atm of  $^3\text{He}$  in terms of sensitivity and unit length.

## Sizes

### Inches (mm)

<b>Diameter</b>	0.5" (12.7)	0.75" (19)	1.0" (25.4)	1.125" (28.9)
<b>Maximum active length</b>	45" (1143)	70.5" (1790)	70.5" (1790)	70.5" (1790)

Neutron sensitive materials are  $^3\text{He}$  gas and boron enriched in the  $^{10}\text{B}$  isotope.

## Materials of construction

**Proportional fill gas:** Typically  $^3\text{He}$  + Ar and  $\text{CO}_2$   
(Fill pressures are generally 1 atmosphere or less, depending on the amount of  $^3\text{He}$  added.)

**Detector:** Stainless Steel or Aluminum

**Insulators:** Alumina Ceramic

## Connector options:

**$\geq 1$  inch diameter** HN connectors are standard, SHV, MHV and wire leads optional.

Insulators in the connectors are Teflon

(for high radiation applications, both Rexolite and alumina Ceramic insulators are available)

**$< 1$  inch** diameter both SHV and MHV connectors are standard, wire leads are optional.

Insulators in these connectors are only offered in Teflon

## Specifications

**Operating voltage:** varies based on  $^3\text{He}$  partial pressure

**Insulation Resistance:**  $10^{12}$  ohms @  $25^\circ\text{C}$

**Capacitance:** ~8 to 12 pf

## Typical maximum ratings

**Voltage:** 1500 volts

**Temperature:**  $55^\circ\text{C}$



